

**REDISCOVERY AND SPECIES STATUS OF THE NEOTROPICAL
SWALLOWTAIL BUTTERFLY *PAPILIO ILLUMINATUS*
NIEPELT (LEPIDOPTERA: PAPILIONIDAE)**

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Abstract.—*Protesilaus illuminatus* (Niepelt), unrecorded since its 1928 description, is given species status based on study of recent specimens from the Rio Putumayo valley of Colombia, syntypical material and wing and genitalic characters of congeners. A lectotype is designated.

For several years a reputedly undescribed swallowtail butterfly belonging to the group *Eurytides* sens. lat. was reported to be circulating on the commercial butterfly market. Taxa of this group "differ . . . widely in adult external appearance" (Munroe, 1961) making unidentifiable specimens of particular interest to collectors and commercial dealers. Photographs of two of five reported specimens of this taxon (Fig. 1A-C) had been sent from commercial dealers to at least two scientific institutions (Allyn Museum of Entomology [AME], Lee D. Miller, pers. comm., and British Museum, Natural History [BMNH], second author, pers. comm.) and two collector/appraisers (the second and third authors) for confirmation of this apparent undescribed status. These two specimens had been obtained in 1981 by Mr. Jerry Schlommer, a commercial dealer, from local collectors on the Rio Putumayo, Colombia. The butterflies were characterized by three large white triangular patches on the hindwing upperside, contrasting the markings of known congeners which display either (1) patches over the entire surfaces of one or both wings (Fig. 1D) or (2) variously large red and/or white ellipses or dots on this area of the wing (Fig. 1E). From the photographs, Miller and the second and third authors confirmed the apparent uniqueness of these specimens to their owners. Until recently, however, none of the specimens was available for scientific study. In 1985, Mr. Rozycki purchased and donated the photographed specimens for taxonomic study. Subsequently, during review of data assembled in this study Dr. Keith S. Brown (Dept. of Zoology, Universidade Estadual de Campinas, São Paulo, Brazil), who is preparing a synonymic list of Neotropical Papilionidae, discovered that, despite the brevity of a 1928 original description, a syntype of *Papilio gayi* [sic] *illuminatus* Niepelt extant in the Museu Nacional (MNR), Rio de Janeiro, Brazil (Fig. 2A, B) seemed nearly identical to the AMNH assembled specimens. As a result, our eventual study concerned both the status and affinities of the AMNH Rio Putumayo specimens and that of *illuminatus*, which had apparently not been referred to in the scientific literature since its original description (Beattie, 1976).

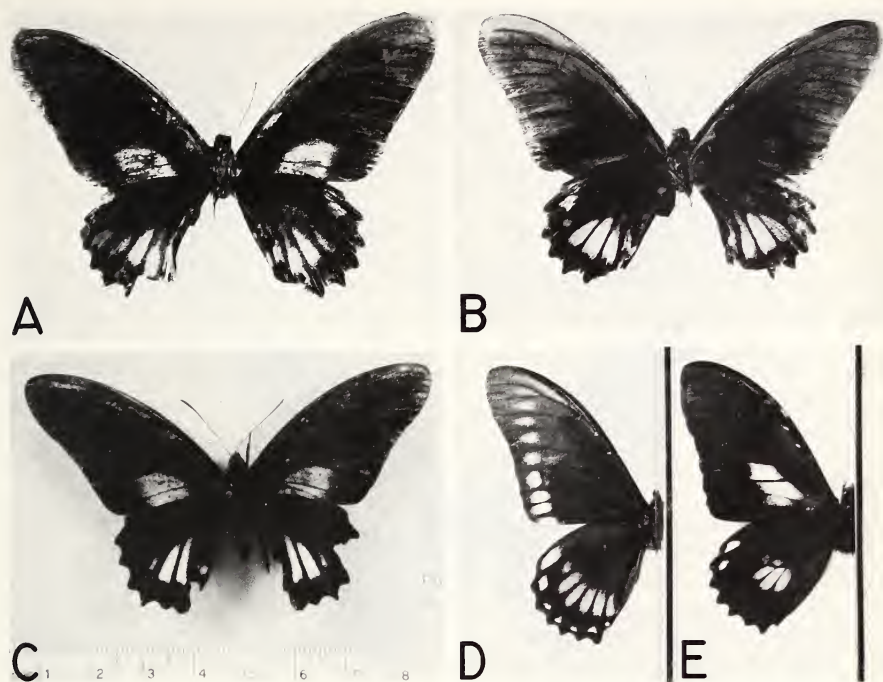


Fig. 1. Specimens of *Protesilaus illuminatus* caught in 1981 in the Rio Putumayo valley, Colombia, A-C (A-B, upper surface; C, under surface). D. *P. phaon* (Colombia, AMNH), a banded taxon. E. *P. euryleon* (Balzabamba, Ecuador, AMNH), a taxon with red hindwing orbs.

TAXONOMIC ANALYSIS

Both Munroe (1961) and Hancock (1983) placed taxa with the combinations of wing marking mentioned above in a "*Lysithous*-related group" of *Protesilaus* (hereafter "*Protesilaus*"), Munroe placing *Protesilaus* as a subgenus of *Eurytides*, Hancock giving the former full generic status. Irrespective of this difference both authors included the following taxa in the group: *pausanias* (Hewitson), *protodamas* (Godart), *microdamas* (Burmeister), *phaon* (Boisduval), *chibcha* (Fassl), *euryleon* (Hewitson), *hipparchus* (Staudinger), *harmodius* (Doubleday), *trapeza* (Rothschild and Jordan), *xynias* (Hewitson), *ariarathes* (Esper), *ilus* (Fabricius), *branchus* (Doubleday), *belesis* (Bates), *thymbraeus* (Boisduval), *lysithous* (Hübner), *kumbachi* (Vogeler), and *asius* (Fabricius). The outstanding wing morph differences amongst these taxa can be summarized as follows. All are untailed mimics of Troidini (Papilionidae) or Heliconiinae (Nymphalidae) except tailed *thymbraeus*, *lysithous* and *asius*. Of those untailed, all have mostly red (but sometimes white) circular or elliptical upperside-hindwing markings (Troidini mimics) except (1) *phaon*, *protodamas* and *microdamas* which have white, yellow-green (or these red-tinted) bands and (2) *pausanias* and a *protodamas* form which have a broad median yellow patch on the forewing (Heliconiinae mimics).

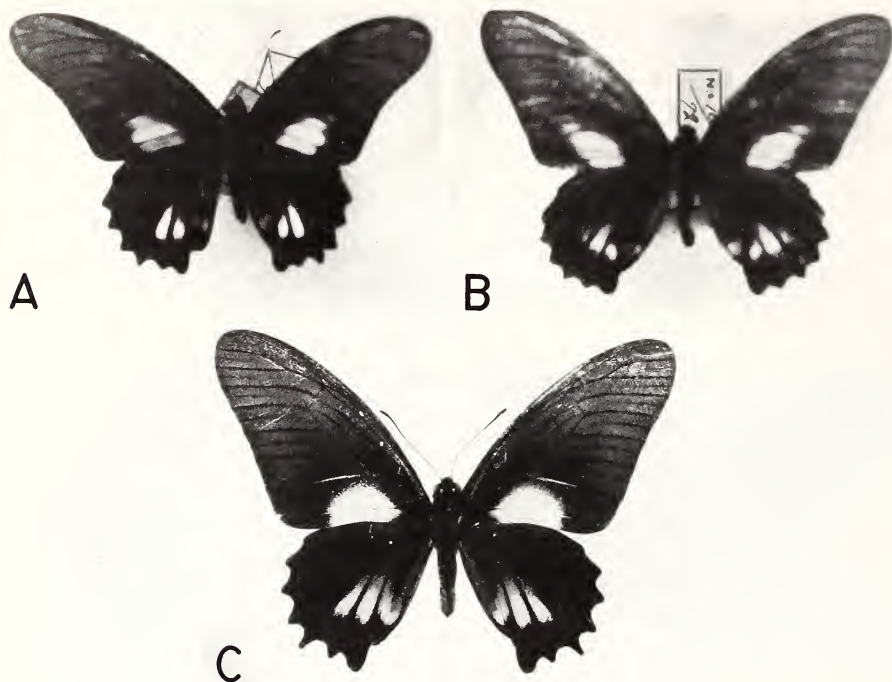


Fig. 2. A. Lectotype male, *P. illuminatus* (MNR), upper surface; B. Allotype female, *P. illuminatus* (MNR), upper surface; C. *P. ariarathes gayi* (Janjui, Peru, AMNH) with red triangular hindwing patches otherwise shaped like those of *illuminatus*.

Munroe (1961) and Hancock (1983) emphasized characters of the male valval harpe in distinguishing taxa of this group. Beutelspacher and Howe (1984) illustrated differences in the valvae which diagnose taxa of *Eurytides* sens. lat. occurring in Mexico. We have studied the male genitalia of *Protesilaus* taxa and in Figures 3–5 illustrate valvae of twenty-one taxa, summarizing our comments on characters in the following REMARKS. When compared to all *Eurytides* and *Protesilaus* taxa, male genitalia of species of tailless *Protesilaus* are relatively alike. However, among them five general subgroups are recognizable. These subgroups correspond closely with the arrangement of D’Abrera (1981) based on wing pattern. Accordingly, for purposes of this paper and in concurrence with group names suggested by Dr. K. S. Brown (pers. comm.) we treat these as follows, citing D’Abrera (1981) plate numbers first, followed by our figure numbers: the “*phaon*” cluster (pp. 62–63) (Fig. 3); the “*harmodius*” cluster (pp. 64–65) (Fig. 4); the “*ariarathes*” cluster (pp. 66–67 [top]) (Fig. 4); the “*belesis*” cluster (p. 67 [bottom]) (Fig. 5), and a possibly previously unrecognized cluster consisting of *microdamas* (figured alone by D’Abrera, p. 63) (Fig. 5), *P. dospassosi* (Rüttimeyer) and possibly *P. huanacana* (deLuque) (Johnson, Matusik and Rozycki, 1986). None of these two latter taxa was included in *Protesilaus* by D’Abrera (1981) or Hancock (1983) due to the taxa being either little-

known or misdiagnosed pending dissection (*dospassosi* as a *Heracleides sensu* Hancock, 1983). Significantly, male genitalia of *P. microdamas* differ from all other tailless *Protesilaus* in lacking the ventrad protruding process of the mesio-ventral surface of the valval harpe (*sensu* Munroe, 1961). The type of *P. dospassosi* and some specimens otherwise like *P. huanucana* also lack this process (Johnson, Matusik and Rozycki, 1986). It is generally considered (Hancock, 1983, and pers. comm., K. S. Brown, pers. comm.) that the taxa *kumbachi* and *chibcha* are aberrations of *P. lysithous* and *P. euryleon*, respectively. They are, therefore, not given further consideration in this paper pending an effort by us to locate their types.

As predictable from wing characters, genitalia of the AMNH Rio Putumayo specimens (Fig. 3G) indicate association with the *phaon* cluster. However, these specimens, the *illuminatus* syntype (MNR, extant of three original syntypes) and one additional MNR female *illuminatus* (Figs. 1A–C, 2A, B) are intermediate in wing pattern between the variously banded *phaon*-like taxa (Fig. 1D) and the red-spotted *euryleon*-like taxa (Fig. 1E). This characteristic, which caused lepidopterists to initially regard the Rio Putumayo specimens as undescribed, is further significant because current taxonomic usage would consider any non-red *Protesilaus* from the Rio Putumayo valley as a *P. ariarathes* mimicking unusual white-marked *Parides* known to occur there (K. S. Brown, pers. comm.). Association of *illuminatus* with *ariarathes* is consistent with Niepelt's original designation of the taxon as "*Papilio gayi* Lucas *illuminatus* Niep. n. subsp." (Niepelt, 1928, p. 390). The taxon *gayi* has since been consistently viewed as a subspecies of *ariarathes* (Rothschild and Jordan, 1906; D'Almeida, 1965; D'Abbrera, 1981). In Figure 2C we illustrate an unusual male *ariarathes gayi* (confirmed by genitalic dissection [Fig. 4D]) which has triangular hindwing markings like *illuminatus* but which are red, not white. Overall assessment of the characters of *illuminatus* has led us and Brown to concur that *illuminatus* is a taxon of the *phaon* species cluster and either a distinct species (our view) or in the opinion of Brown a distinct species, or a subspecies of *euryleon*. Given the disparity of the wing pattern of *illuminatus* from *euryleon*, the consistent morph in both males and females of *illuminatus*, and the latter's male genitalia, we propose the following:

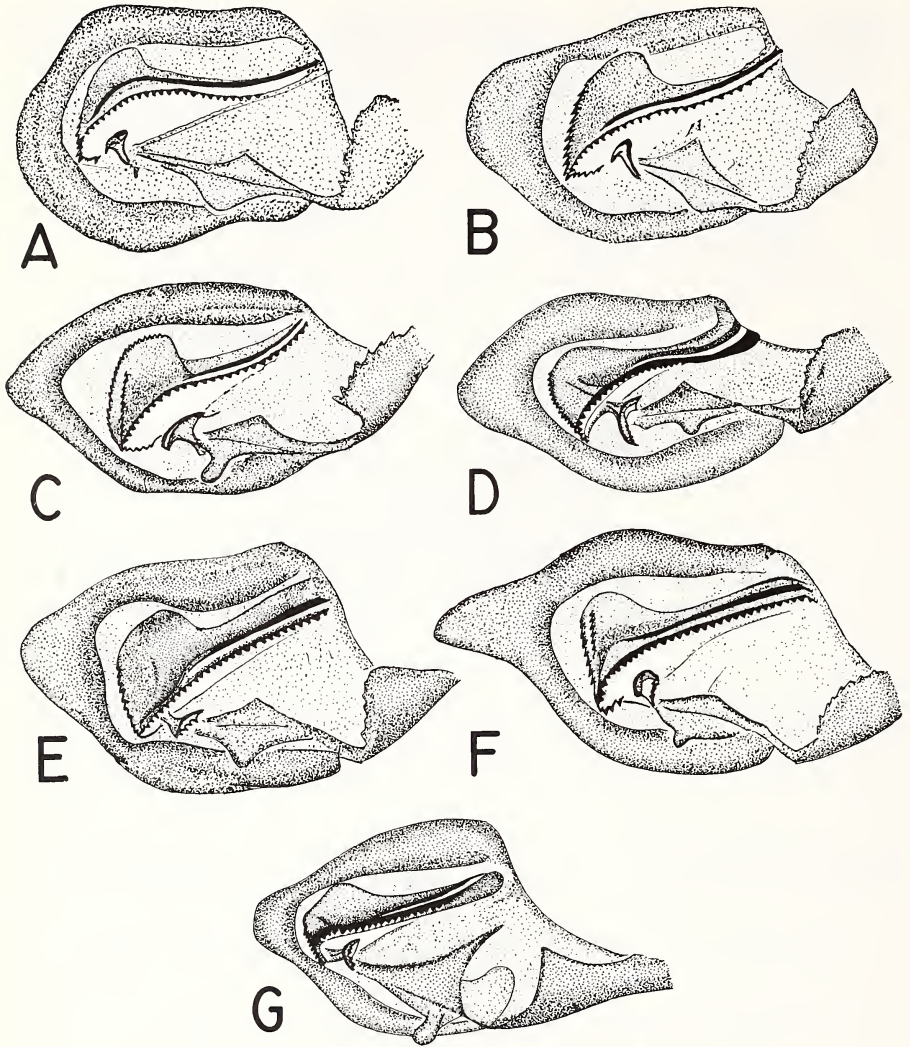
Protesilaus illuminatus (Niepelt), **New Combination, Revised Status**

Figs. 1A–C, 2A, B, 3G

Papilio gayi illuminatus Niepelt, 1928, Int. Entom. zeitschr. 21:390.

Diagnosis. Compared to all other *Protesilaus* readily recognized by three distinct white to cream triangular patches on the hindwing upperside in cells CU_2 , CU_1 and M_3 and a red patch between these and the anal angle. Underside of hindwing similar but with additional red dot postmedian in cell M_2 . In the genitalia distinguishable from all congeners by the dorsal surface of the valval harpe ("keel" *sensu* Johnson, Matusik and Rozycki, 1986) with reduced size caudad, serrated ridge ventrad nearly straight, and markedly large rhomboid-shaped sclerotized area ventrad on the clasper with very elongate ventrally protruding process along the ventral angle (*sensu* Hancock, 1983; Munroe, 1961).

Description. MALE. Upperside of wings: Ground color, both wings, brownish black. Forewing with dull yellow-cream patch in median area from below discal cell



phaon CLUSTER

Fig. 3. Genitalia of the "phaon cluster" (number of dissections, parentheses). A. *pausanius*, Jepelacio, Peru (3); B. *protodamas*, Gavea, Brazil (3); C. *phaon*, Colombia (3); D. *euryleon euryleon*, Costa Rica (3); E. *euryleon haenshi* (Rothschild and Jordan), Balzabamba, Ecuador (3); F. *euryleon pithonius* (Rothschild and Jordan), Cauca Valley, Colombia (3); G. *illuminatus*, Rio Putumayo valley, Colombia (2).

to inner margin. Hindwing with three long triangular yellow-cream patches postmedian to postbasal in cells CU_2 , CU_1 and M_3 . Large red patches between vein 2A and the anal margin. Slight red spots distad each white triangular patch, postmedian from cells CU_2 to M_2 . No tail. Underside of wings: As on upperside but with red dot postmedian in cell M_2 and vivid red at the juncture of wing bases and thorax. Length of forewing 42.0 mm (AMNH male); 38.5 mm Rozycki male.

FEMALE. Upperside of wings: Compared to male, wing shape broader and wing length longer (Fig. 2B); hindwing, anal red spot larger, white postmedian bands more expansive costad, invading cell M_3 . Forewing, median cream-white patch more expansive costad, invading cell M_3 . Underside of wings: Photograph not available. Forewing length: Unavailable.

Male genitalia (Fig. 3G). Caudal "head" of dorsal surface of valval harpe ("keel" *sensu* Johnson, Matusik and Rozycki, 1986) reduced, ventrad serrated ridge nearly straight. "Mesially directed process" (*sensu* Hancock, 1983; Munroe, 1961) extremely narrow and elongate; rhomboid-shaped ventrad sclerotized areas of clasper far larger dorsad than on sister taxa and with prominent ventrally protruding process at ventral angle (*sensu* Hancock, 1983; Munroe, 1961).

Female genitalia. Unknown.

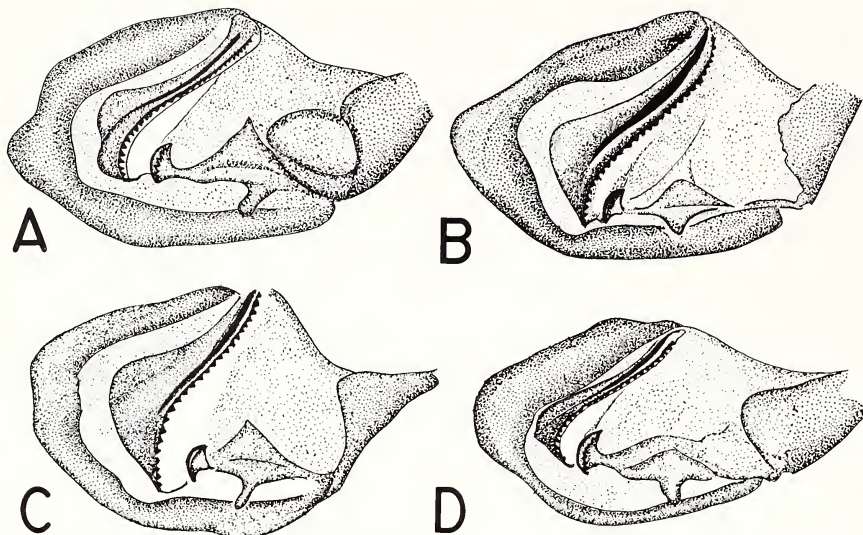
Type. We designate the syntype (Fig. 2A) (MNR), labelled "type *gayi illuminatus* Niepelt, Mocoa, S. Colombia, Oct. 1927, Col. Julius Arp" as lectotype. Location of remaining two syntypes of original description is unknown. Also, we designate the female (Fig. 2B) labelled "*gayi* Luc., [illegible], Col.," as the "designated allotype" *sensu* Smith, 1983. We have requested K. S. Brown to affix labels to this effect. Regarding additional specimens, see REMARKS.

Distribution. Rio Putumayo valley of southern Colombia.

Remarks. *Protesilaus* "*lysithous* group" taxa exhibit a single-layered valval harpe (dark, keel-like structure centrad in Figs. 3–5) with a laterally extending spike associated ventrad and a variously rhomboid structure cephalo-ventrad which has a ventrally extending process. The closely related "marcellus Group" (*sensu* Munroe, 1961) displays a harpe of two parallel layers (a keel beneath a keel) without an emphatic spike and without a ventrally extending process. The keel-like structure in Figures 3–5 consists ventrad of two closely parallel high ridges (drawn in thick solid black) separated by a deep fissure (shown in white or very light gray). The ventrad ridge is variously dentate. The keel can terminate caudad with a variously expressed "head": characteristically single-edged and serrate, double-edged and serrate, or non-serrate in particular species clusters. The laterally pointing spike can be characteristically pointed, furcate, or conical; the ventral process of the rhomboid structure is variously emphatic. Characters of the keel are most useful with features of the lateral spike and ventral process being less reliable but distinctive in some taxa. Exception to the above general configuration occurs in the "*microdamas* cluster," whose taxa have the characteristic keel on the harpe but have a generally caudad-pointing spike and no ventral process. Subject to much intraspecific variation, the less sclerotized areas of the valval clasper surrounding the harpe do not appear diagnostically useful for the groups.

Characters generally diagnostic for each of the species clusters are—"phaon cluster": keel with moderately enlarged head and faint to moderate evidence of a double-edge, each edge evidencing serration or at least a second incline toward the parallel

ariarathes CLUSTER



harmodius CLUSTER

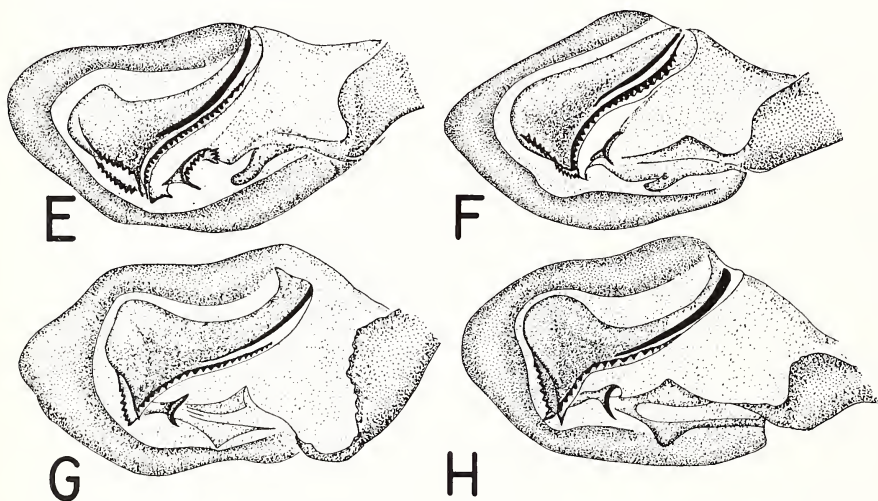
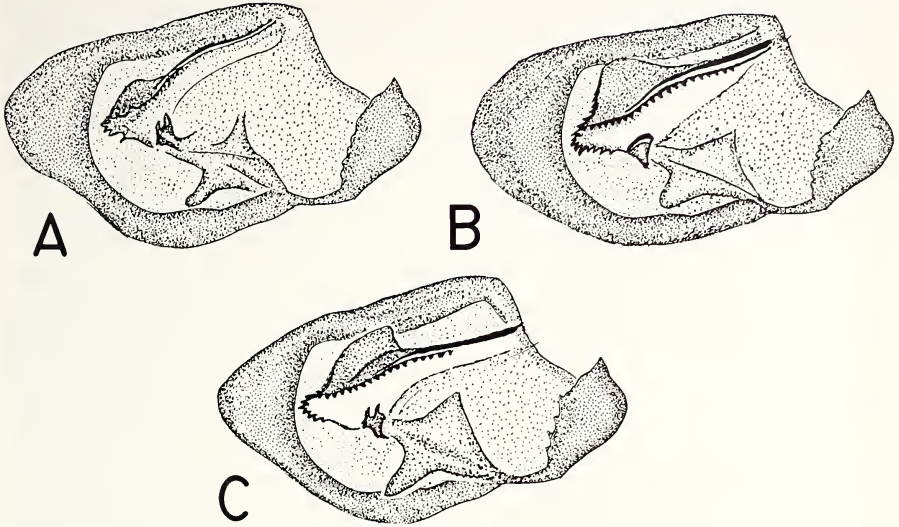


Fig. 4. Genitalia of the "ariarathes cluster" (A-D) and the "harmodius cluster" (E-H) (number of dissections, parentheses, other localities, brackets). A. *ariarathes ariarathes*, French Guiana (3); B. *ariarathes gayi* f. *cyamon* (Grey), Middle Rio Ucayali, Peru (3), Alto Juruá, Brazil (1) [additional studied: *gayi gayi*, Janjui, Peru (1), Buena Vista, Bolivia (1); *gayi metagenes* (Rothschild and Jordan), Mt. Duida, Venezuela (1)]; C. *ariarathes menes* (Rothschild and Jordan), Tukeit, Guyana (3); D. *ariarathes* of Figure 2C, Janjui, Peru; E. *harmodius harmodius*, Bolivia (3); F. *harmodius xenoides* (Hewitson), Rio Pastaza, Ecuador (3); G. *trapeza*, Rio Napo, Ecuador (3); H. *xynias*, Rio Santiago, Peru (3).

belesis CLUSTER



microdamas CLUSTER

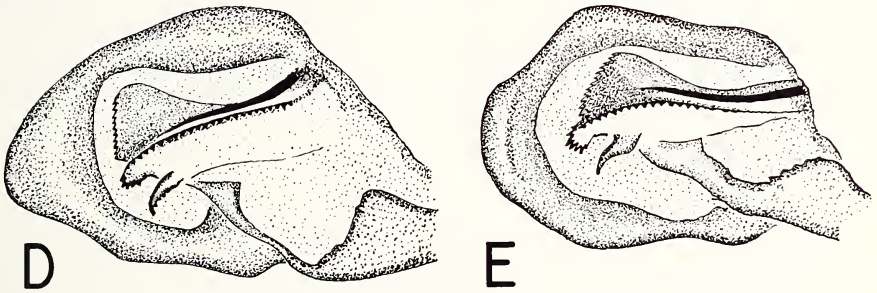


Fig. 5. Genitalia of the “*belesis* cluster” (A–C) and “*microdamas* cluster” (D, E) (number of dissections, parentheses). A. *belesis*, Soyolapan, Mexico (3); B. *branchus*, San Jeronimo (Chiapas), Mexico (3); C. *ilus*, Sosumuco, Colombia (3); D. *microdamas*, Sapucay, Paraguay (5); E. *dospassosi* (holotype), Rio Putumayo, Colombia.

ridges; lateral process generally conical; ventral process variously emphatic; “*harmodius* cluster”: head of keel extremely enlarged and usually severely angled; double-edge distinct with both surfaces heavily serrate; lateral process conical, thin-edged and extremely arc-shaped terminad; ventral process variously expressed as generally small rhomboid structure; “*ariarathes* cluster”: keel smoothly inclined with generally moderate to diminutive head, single-edged and generally non-serrate; lateral process

conical with the angle of its arc positioned closely parallel to that of the keel (very noticeable in the dissections, lateral processes of other taxa clusters being variously at odd angles to the keel); rhomboid structure small, with the ventral process usually narrow to pronounced; "*belesis* cluster": keel curved irregularly ventrad with caudad dentate areas flared notably outward; head variously serrate, single-edged, often inclined laterally; lateral process furcate in two taxa, conical in the third; rhomboid structure moderately large with ventrad process very emphatic and often wide; "*microdamas* cluster": no ventral process, rhomboid structure occurring only dorsad; caphalo-ventral "shoulder" connects clasper to vinculum widely adjoined to ventrad areas of the clasper; keel variously inclined or with an emphatic head, single-edged and serrate caudad; lateral process thinly pointed and angled markedly dorsad.

Nine specimens of *P. illuminatus* are known or have been reported in the literature. These are as follows: Niepelt (1928) three syntype males; MNR, one female; AMNH, one male; and R. Rozycki collection (Chicago, Illinois), one male. The remaining three specimens are males in the possession of a commercial dealer who wishes to remain anonymous. These have been examined and identified by the third author. The last five specimens mentioned above have been collected since 1981. This apparent rarity is not unusual among Neotropical Papilionidae. For example, Johnson, Rozycki and Matusik (1985) confirmed only seventeen known specimens of *Pterourus xanthopleura* (Godman and Salvin) in thirteen major United States, European and South American museums. Only three of these specimens are in South American collections. *P. xanthopleura* is a well-known swallowtail butterfly, popular with collectors and commercially sought after. The above persons also located only three specimens of *P. diaphora* (Staudinger), the sister species of *xanthopleura*. Apparent scarcity, therefore, or limitation to a localized habitat should not prejudice the apparent species status accorded *illuminatus*. There are numerous Papilionidae species which are known from, or at least only collectable at, particular limited locales (*Battus zetides* Munroe, *B. streckerianus* Honrath, *Heraclides moroni* [Moreau], D'Abrera, 1981).

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LITERATURE CITED

- Beattie, J. R. 1976. The Rhopalocera Directory. J. B. Indexes, Berkeley, California, 365 pp.
- Beutelspacher, C. R. and W. H. Howe. 1984. Mariposas de Mexico. Fasculo I., Papilionidae. La Preusa Medica Mexicana, S.A., Mexico City, xii + 128 pp.
- D'Abrera, B. 1981. Butterflies of the Neotropical Region. Part 1. Papilionidae and Pieridae. Lansdowne Editions, East Melbourne, 172 pp.
- D'Almeida, R. F. 1965. Catalogo dos Papilionidae Americanos. Sociedade Brasileira de Entomologia, São Paulo, 366 pp.
- Hancock, D. 1983. Classification of the Papilionidae (Lepidoptera): a phylogenetic approach. *Smithersia* 2:1-48.
- Johnson, K., D. Matusik and R. Rozycki. 1986. A study of *Protesilaus microdamas* (Burmeister) and the little-known *P. dospassosi* (Rüttimeyer) and *P. huanucana* (deLuque), Papilionidae. *J. Res. Lepid.* (in press).
- Johnson, K., R. Rozycki and D. Matusik. 1985. Species status and the hitherto unrecognized male of *Papilio diaphora* Staudinger (1891), (Lepidoptera: Papilionidae). *J. New York Entomol. Soc.* 93:1089-1095.
- Munroe, E. 1961. The classification of the Papilionidae (Lepidoptera). *Can. Entomol. Suppl.* 17, 51 pp.
- Niepelt, W. 1928. Neue Tagfalter aus Columbien. *Int. Entom. Zeitschr.* 21:390.
- Rothschild, W. and K. Jordan. 1906. A revision of the American Papilios. *Novit. Zool.* 13: 412-752.
- Smith, H. M. 1983. More on allotypes. *Syst. Zool.* 32:454-455.

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